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PBS&J and the
Center for Research in Water Resources
University of Texas at Austin

Enhanced Arc Hydro Enterprise Database (AHED)

Physical Design Document for South Florida Water Management District

Task 2.3.2

PBS&J

CRWR

AHED Physical Design Document

Table of Contents

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South Florida Water Management District
Arc Hydro Enterprise Database (AHED)
Physical Design Document

1.0 Introduction

The Arc Hydro Enterprise Database (AHED) is a customization for South Florida Water Management District (SFWMD) of the national Arc Hydro geodatabase design from Environmental Systems Research Institute (ESRI) and the University of Texas at Austin Center for Research in Water Resources (CRWR). The customizations are designed to support the unique environments of South Florida including the extensive network of canals and control structures and the resulting multiple system-variable outfalls for each watershed. The design is targeted at supporting the common data needs of four key project types during the initial implementation, thus eliminating redundancy and resolving previously incompatible spatial data layers. The AHED design provides a centralized index into detailed project data, a relational data structure for displaying model and gauge results for quality control and decision support, and AHED is a platform from which to model water balance across the district. The logical design of the AHED geodatabase is described in a separate document: *AHED Logical Design Document for South Florida Water Management District.*

This document is the Physical Design Document; it is intended to describe the Information Systems details under which the AHED design will be implemented at the District and the procedures for implementing and loading the database schema on the District's Oracle Development server.

2.0 AHED Physical Configuration

The physical configuration section is provided in two parts. First is a conceptual description of the ultimate configuration of AHED and related geodatabases that will support the AHED production system. Current estimates from District staff place this implementation following ArcGIS 9.0 rollout in early 2005. Second is the detailed configuration description required to implement AHED on the current District Oracle 8i and ArcSDE 9.0 testbed.

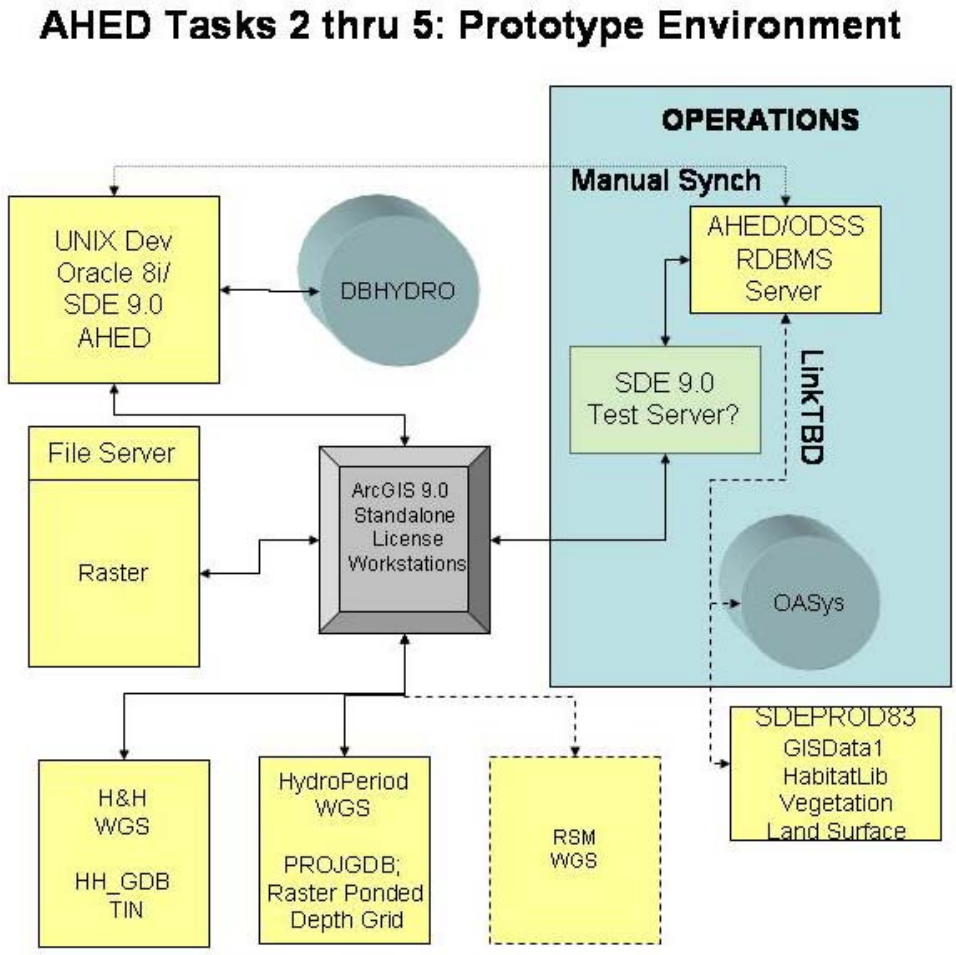
2.1 AHED Prototype Configuration for District Oracle/SDE Testbed

AHED040720 is the deliverable version of AHED which has been through District reviews for attributes and relationships using sample data and is prepared for training using the AHED toolset. AHED was provided as a personal geodatabase during the review period and at the time of writing has been installed on an Oracle testbed at the

District to demonstrate compatibility. The training version: AHED040817 has been loaded on the District testbed configured for Oracle 8i and ArcSDE 9.0. The details and parameters required for setting up the Oracle tablespaces for the test server are included here.

2.1.1 Prototype Configuration Diagram

Figure 1. Configuration of AHED prototype for AHED Tasks 2 through 5 prototypes: Task 2-core AHED; 3-Hydroperiod; 4-Hydrologic and Hydraulic(H&H) modeling; and 5 -Operation Decision Support/SCADA/AHED Integration.



2.1.2 Oracle Configuration / Sizing for Prototype

The Oracle server configuration for the prototype was handled by SFWMD. The following configuration was agreed to with the District Oracle Database Administrator for setting up the AHED prototype testbed on a Sun workstation.

The SDE database is to be called SFAHD. The database schema is called AHED and will be the custodian account for the database. AHED will assign permissions to

individual user accounts granting insert, update, and delete permissions for specific datasets. There is one role called "ahedvwr" that has read access to all data. Roles and permissions can be updated once we have a better understanding of work flow and editing requirements. Table 1 lists the Oracle tablespaces and size allocations.

Table 1. AHED Testbed Oracle Configuration.

Oracle:	size(MB)
System	1500
Tools	500
Temp	1500
Rollback	1500
Redo log files	1500
Users	50
Users index	50
Platuser	10
Portal	10
Drsys	200
Sde	200
	5640
Data Tablespaces:	
Aheddata	3000
Ahedindex	3000
	6000
Total:	11,640

Prototype DBTune File

Using the Keyword Section "GISLIB_LARGE" in SFWMD's existing DBTUNE file, PBS&J created a new AHED keyword section to be appended to SFWMD's DBTUNE file. The ArcSDE 9 DBTUNE file was tested on an Oracle 8i instance under ArcSDE 9.0 on one of PBS&J's development servers before delivery to the District. The three tablespaces used, SDE, AHEDDATA, and AHEDINDEX were the tablespaces specified by SFWMD staff.

The following Tablespaces were defined for the various DBTUNE parameters:

1. Tablespace SDE. Assigned to all SDE Data Dictionary objects including SDE indexes.
2. Tablespace AHEDDATA. Assigned to all user table parameters.
3. Tablespace AHEDINDEX. Assigned to all spatial and attribute index parameters.

Additional Notes:

1. DBTUNE has been setup where all data will be loaded using the Defaults irrespective of the Oracle user account name. No Configuration Keywords need to be specified when loading data using ArcCatalog.

2. A large rollback segment (example: 300 Mbytes) was included. This is recommended by ESRI for use with Oracle 8i to enhance compress performance. This rollback segment is specified in the DBTUNE file using the following parameter:

   COMPRESS_ROLLBACK_SEGMENT "RBS_BIG"

   Create the above rollback segment "RBS_BIG" before creating the ArcSDE data dictionary tables by using the SDE command: "sdesetupora8i -o install".

   The resulting DBTUNE file is attached as Appendix A.

2.2 AHED Next Generation Prototype Configuration for District Oracle/SDE

The ultimate configuration of the AHED for production, including the disposition of related project-specific geodatabases and a replication of AHED under Operations is described here in conceptual form. The detailed production implementation of AHED will require integration with policies for data maintenance and update (as described in the SFWMD GIS Data Management Operations and Maintenance Guide) as well as migration of mapping and GIS support procedures currently performed under Arc/INFO 8.x. It is assumed these policies will also require updating to reflect the reorganization at the District.

2.2.1 Next Generation Configuration Diagram

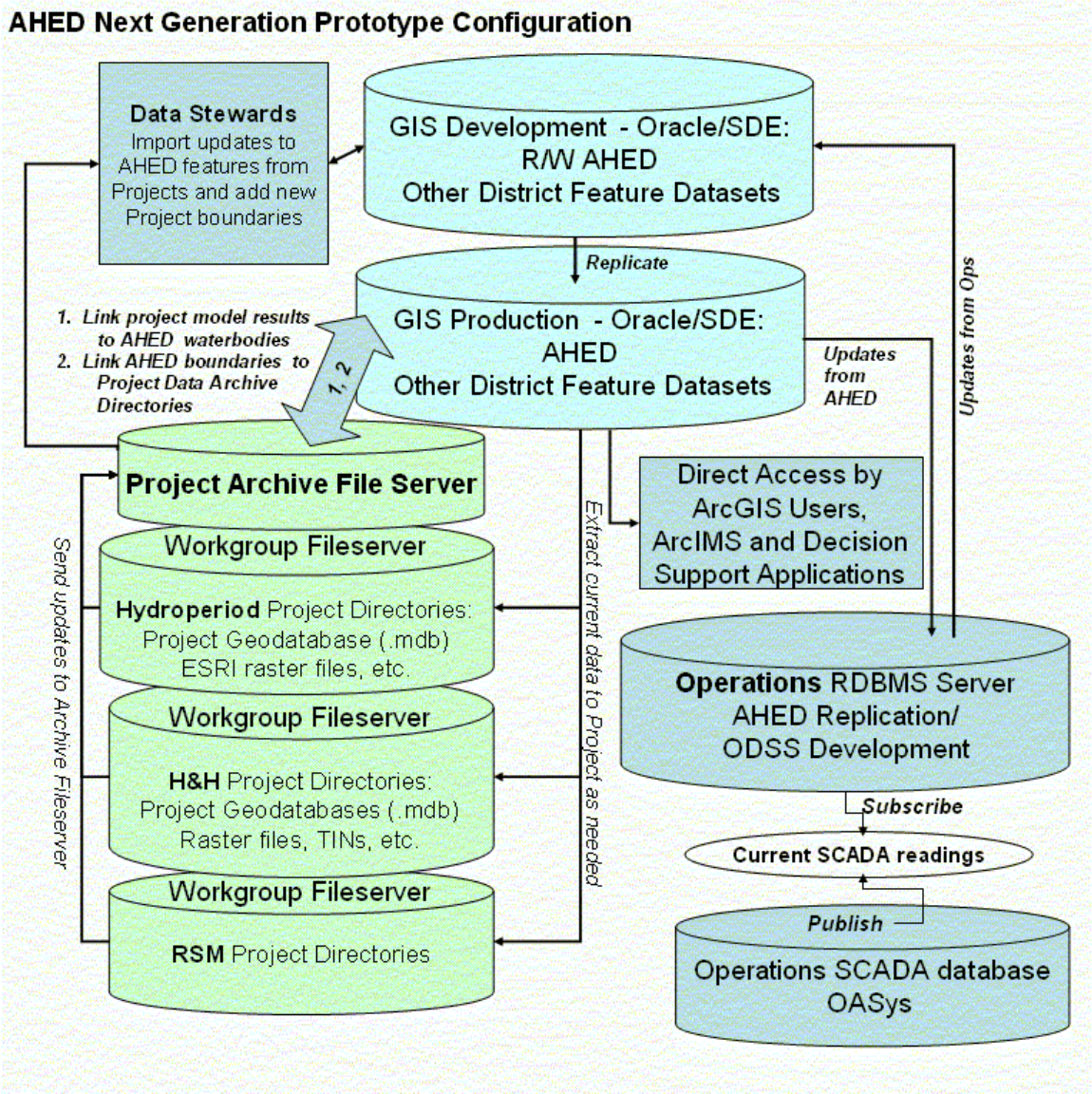
A conceptual understanding of the intended production configuration for AHED is key to fully realizing its capabilities. Figure 2 shows the conceptual layout proposed for AHED with related files and directories.

The Configuration Diagram lays out the basic concept of:

1. Creating a versioned read/write instance of the AHED for editing and maintenance then
2. Replicating it to an unversioned read-only instance.

While similar capabilities can be achieved by utilizing a single versioned instance with read/write access granted to stewards only, in the real-world there are too many potential pitfalls in the versioned, multi-edit SDE environment to make it suitable for simultaneous use as an editing environment and as a high-performance, high-availability data-delivery platform. The combination of greater security, significantly greater performance, and disaster recovery afforded by running two separate servers makes the two server configuration ideal.

Figure 2. The preferred Next Generation prototype with two Oracle/SDE servers – a read/write server for data development and a read-only replicate for GIS Production.



Additional details of Figure 2 show the interaction between the AHED geodatabase and other key components: a synchronized instance of AHED to be designed for Operations under AHED Task 5 in late 2004/early 2005; project directories containing project geodatabases in Microsoft Database format (Access .mdb) with related ESRI raster and terrain data stored outside the geodatabase; direct access to the AHED geodatabase for loading common data as well as for existing GIS mapping activities; and direct access for planned Decision Support applications including water balance modeling.

Operations will replicate the AHED geodatabase in order to work on a copy for development of the AHED/ODSS/OaSys integration. The replication of data from

AHED to Operations will be ongoing. Flowing back to AHED, as any additions to the Operations instance are designed, tested, and accepted, they will be introduced to the core AHED development environment. Similarly, applications in support of ODSS will be available for other District uses through the core AHED. One net result of the Operations updates is the design of an additional capability for AHED to display current values from SCADA sensors.

Project geodatabases have been designed for Hydroperiod and H&H. Both are designed to provide a repository for detailed project data that is linked to and compatible with the regional AHED data model. The fundamental underlying concept is that Oracle-based geodatabases that are distributed using the ESRI Spatial Database Engine (SDE) are designed for regional shared base data layers. Local project-specific datasets are most cost-effective, easier to administrate, and easier to work on when stored on a workgroup fileserver as an .mdb project geodatabase. The 2 Gigabyte limit on personal geodatabases is not a problem for project datasets, as long as the raster and terrain data are being stored in a project subdirectory as designed. The primary consideration for maintaining connectivity between the AHED and project geodatabases will be to define a work flow for updating features and implementing a strategy for maintaining HydroIDs between the geodatabases. SFWMD will work to develop a strategy for connectivity during enterprise AHED implementation. One option that has been presented is a tool developed for the SWFWMD Arc Hydro implementation. The "GeoDataset Exchange" program supports transferring entire or part of a source Arc Hydro GeoDataset to another target Arc Hydro GeoDataset. In order to manage the unique HydroID and related identifiers defined in the Arc Hydro data model, the program provides functionalities to maintain the unique identifier and database integrity.

By referencing an AHED Hydrojunction ID in key feature classes of the project geodatabases, it is possible to link results from the project models back to be displayed in AHED on associated nodes, centerlines, waterbodies, basins or cross-sections.

As AHED is migrated into production, the current mapping and data maintenance activities taking place under Arc/Info will be migrated to ArcGIS. This will afford the District the opportunity to take advantage of the many new features in ArcGIS 9.0 including the model builder for automating routine processes and enhanced mapping, labeling and symbolization capabilities for District cartography. During the period of migration the District will also have the opportunity to develop and test many prototype applications that take advantage of the data structure, relationships and attributes that have been specifically designed to support the business needs and decision support needs for scientific watershed management.

Software Requirements

The Next Generation Prototype will require the following software to support the four tasks:

- UsersArcGIS 9.0
  - ArcGIS 9.0 Extensions:
    - Tracking Analyst (at least 3 copies for Hydroperiod users).
    - DHI Timeseries Tool with DBHydro Bridge (at least 3 copies)
    - AHED Hydroperiod Tools (Task 3; Hydroperiod users).
    - AHED FEMA QC Toobox with Task 4 XP-SWMM plug-in and model checking toolbox.
    - Spatial Analyst – 6 licenses (for Tasks 3 and 4).
    - 3-D Analyst - 3 licenses (for Tasks 3 and 4)
    - *Optional:* DHI Watershed Analyst for Task 4. Export updates to H&H models. At least one license (~$2500).
  - ArcIMS Current version

- Data Stewards (all the above plus):
  - AHED Tools - data maintenance tools (Task 2)
  - Arc Hydro Tools – data maintenance tools (free from ESRI).

- Database Manager (schema changes, reconciling versioned edits, and database compression. All the above plus the following)
  - Visio Professional (2002 or newer).
  - ESRI Semantics checker for Visio
  - ESRI .NET Database Diagrammer

2.2.2 Estimates for Oracle Configuration / Sizing

The Oracle Servers for the Next Generation Configuration can be configured similarly to the Prototype Configuration in 2.1.2. These servers should replace the prototype server and will probably be migrated from the current 8.3 environment. Because hardware/server costs are low relative to the other costs of implementation, new boxes are recommended to transition from the existing 8.3 servers, rather than rebuilding. The new servers could be hooked into existing Storage Arrays Networks.

Table 2 lists the recommended Oracle tablespaces and size allocations, accounting for the increased storage requirements of a full district-wide implementation of AHED. Note that this sizing does not account for all the existing data that are not AHED-related but will nevertheless need to be stored on the GIS server. Additional calculations should be made to size up the GIS 9.0 servers accordingly. It is difficult to overstate the extremely high cost-benefit of sizing the system as generously as possible. Poor system performance due to processor, memory and disk space limitations can bring the best solutions to ruin from lack of use.

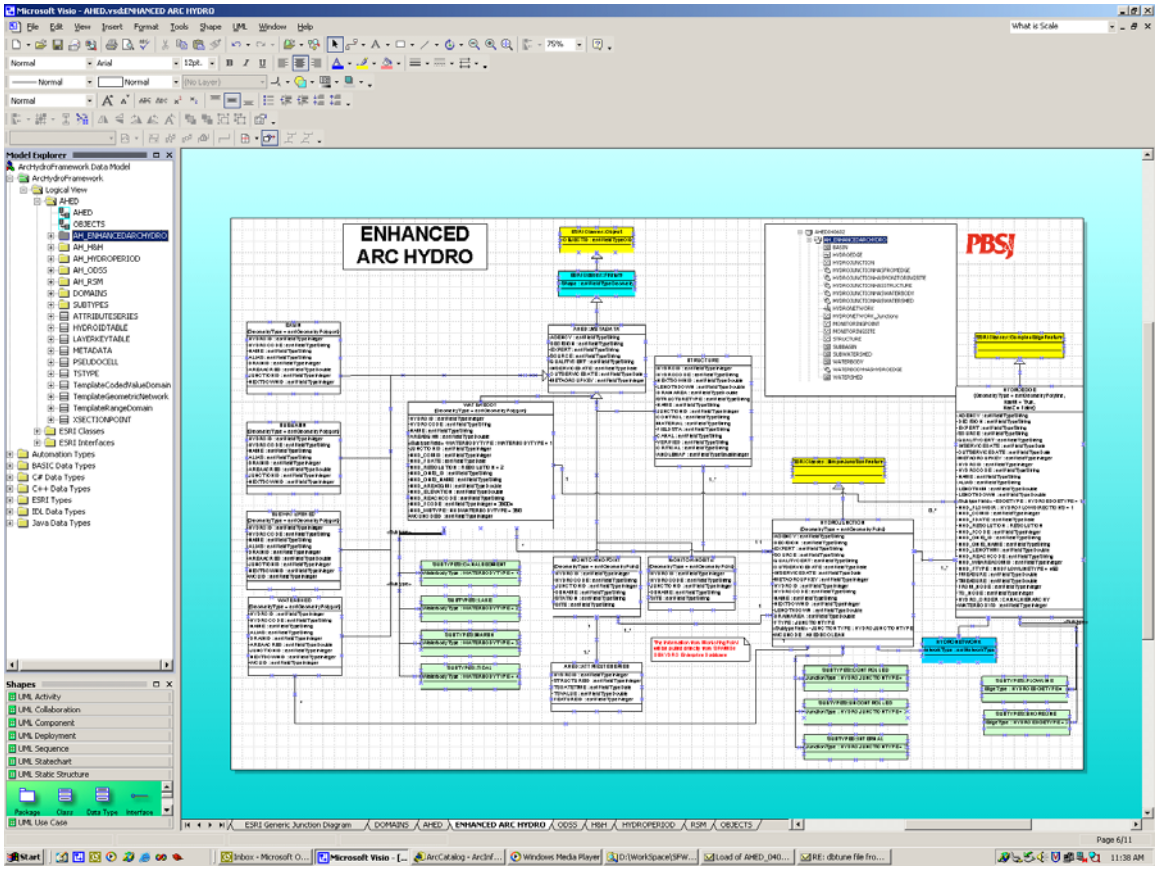
Table 2. AHED Oracle Configuration for Next Generation Prototype Read/Write Server.

Oracle:	size(MB)
System	1500
Tools	500
Temp	1500
Rollback	1500
Redo log files	1500
Users	50
Users index	50
Platuser	10
Portal	10
Drsys	200
Sde	200
	5640
Data Tablespaces:	
Aheddata	53000
Ahedindex	3000
	56,000
Total:	61,640

Table 3. AHED Oracle Configuration for Next Generation Prototype Read-Only Server

Oracle:	size(MB)
System	1500
Tools	500
Temp	1500
Rollback	1000
Redo log files	1000
Users	50
Users index	50
Platuser	10
Portal	10
Drsys	200
Sde	200
	4640
Data Tablespaces:	
Aheddata	53000
Ahedindex	3000
	56000
Total:	60,640

3.0 Implementation of the UML under ArcSDE 9.0



Introduction

Microsoft Visio 2002 Professional is a software package used to develop Unified Modeling Language (UML) Models. ESRI has created an add-on to Microsoft Visio 2002 Professional called "ESRI Semantics Checker" that will help users develop a schema in a UML environment that will have the capability to be loaded into Arc Catalog to create either a personal or enterprise geodatabase. The Arc Hydro Enterprise Database was created using this technology. See link below for further information on the "Semantic Checker add-on for Visio.
http://support.esri.com/index.cfm?fa=knowledgebase.techarticles.articleShow&d=24446

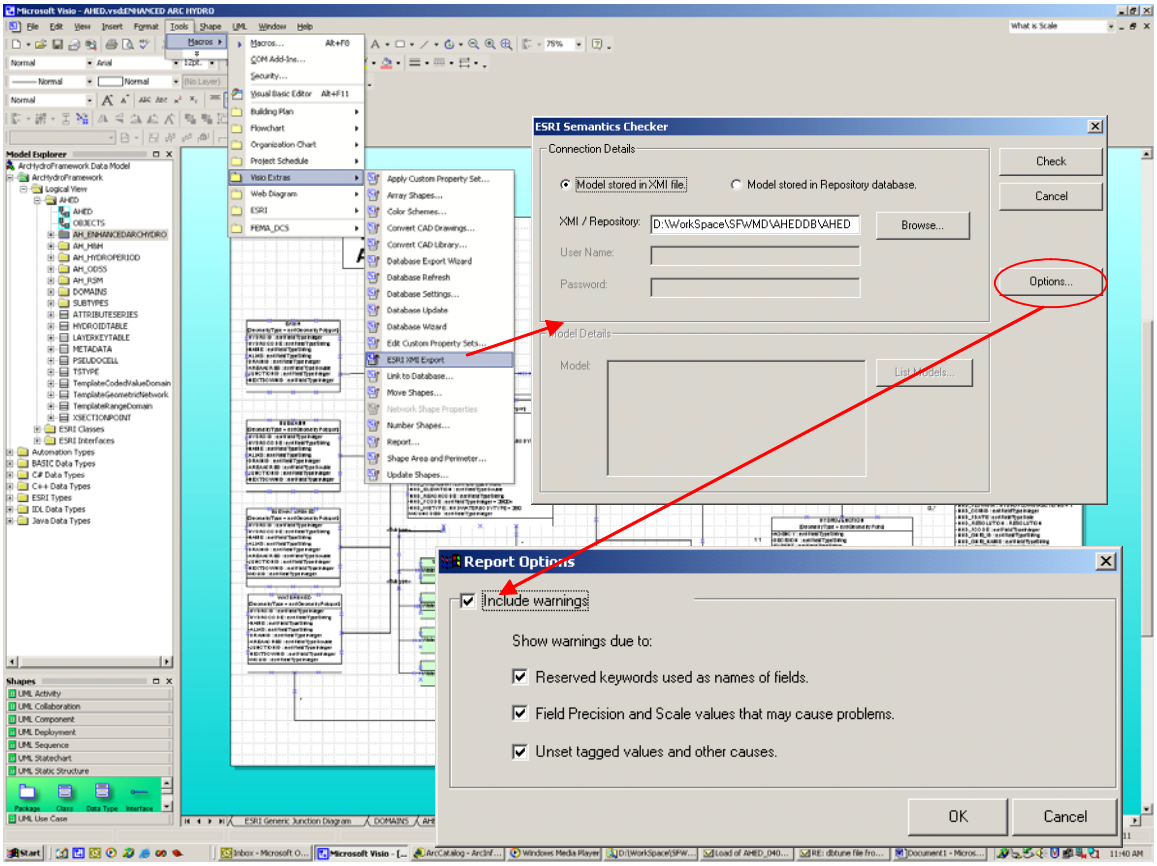
The overall steps required to create the Schema and Load the data into the AHED ArcSDE Enterprise Geodatabase are:

1. Create the AHED Schema by exporting the UML to an xml file (Use ESRI Semantics Checker extension).
2. Use the xml file as input to the ArcCatalog Create Schema Wizard.
3. Version each Feature Dataset.

4. Load any feature class that is a member of a Feature Dataset into the new Schema using the ArcMap Load Objects command.
5. Load any Standalone Table data using the ArcCatalog Load Data command.
6. Perform a Compress of the Geodatabase
7. Recreate any Geometric Networks
8. Perform a final compress of the Geodatabase.

1. Export and Check the Data Model

Data is exported from the data model to an XML file to be checked by the ESRI Semantics Checker in Microsoft Visio 2002. Users have the option to include warnings, such as identifying reserved keywords used as names of fields, field precision and scale values that may cause problems, and unset tagged values or similar causes that may inhibit the schema to be loaded into SDE and Oracle. See below.



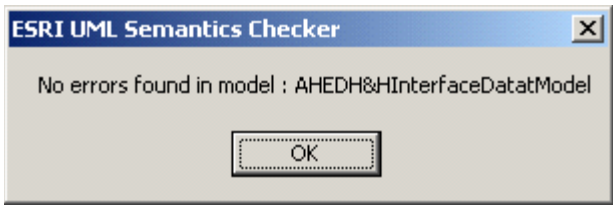
If errors occur an "Error Report" will appear. This can either be printed or exported to a .PDF.

UML Model Error Report.
Model : ArcHydroFramework

5/28/2004 11:11:21 AM

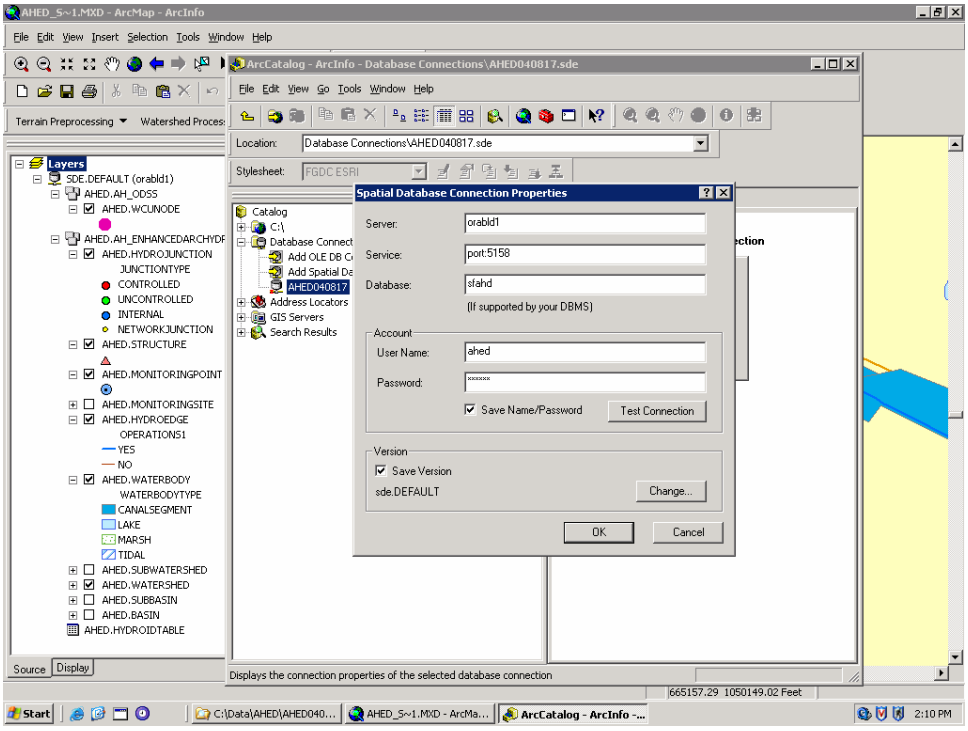
Element name	Type	Num	Description	Severity	Path
WATERBODYHASHYDROEDGE	RelationshipClass	7	Invalid tagged value for RelationshipClass : WATERBODYHASHYDROEDGE Tagged value : OriginForeignKey Value : WATERBODYID	Error	Logical View:AHED:AH_ENHANCEDARCHYDRO :WATERBODYHASHYDROEDGE
WATERBODYHASHYDROEDGE	RelationshipClass	57	Primary/Foreign keys are not set for relationship class. Relationship class : WATERBODYHASHYDROEDGE.	Error	Logical View:AHED:AH_ENHANCEDARCHYDRO :WATERBODYHASHYDROEDGE
WATERBODYHASHYDROEDGE	RelationshipClass	58	Primary/Foreign keys are not type-compatible for relationship class. Relationship class : WATERBODYHASHYDROEDGE.	Error	Logical View:AHED:AH_ENHANCEDARCHYDRO :WATERBODYHASHYDROEDGE

If the data model has no errors you will see the following:



2. Using the "Schema Wizard" in Arc Catalog to Create the SDE Enterprise Database

Connect to SDE 9 Test Server:

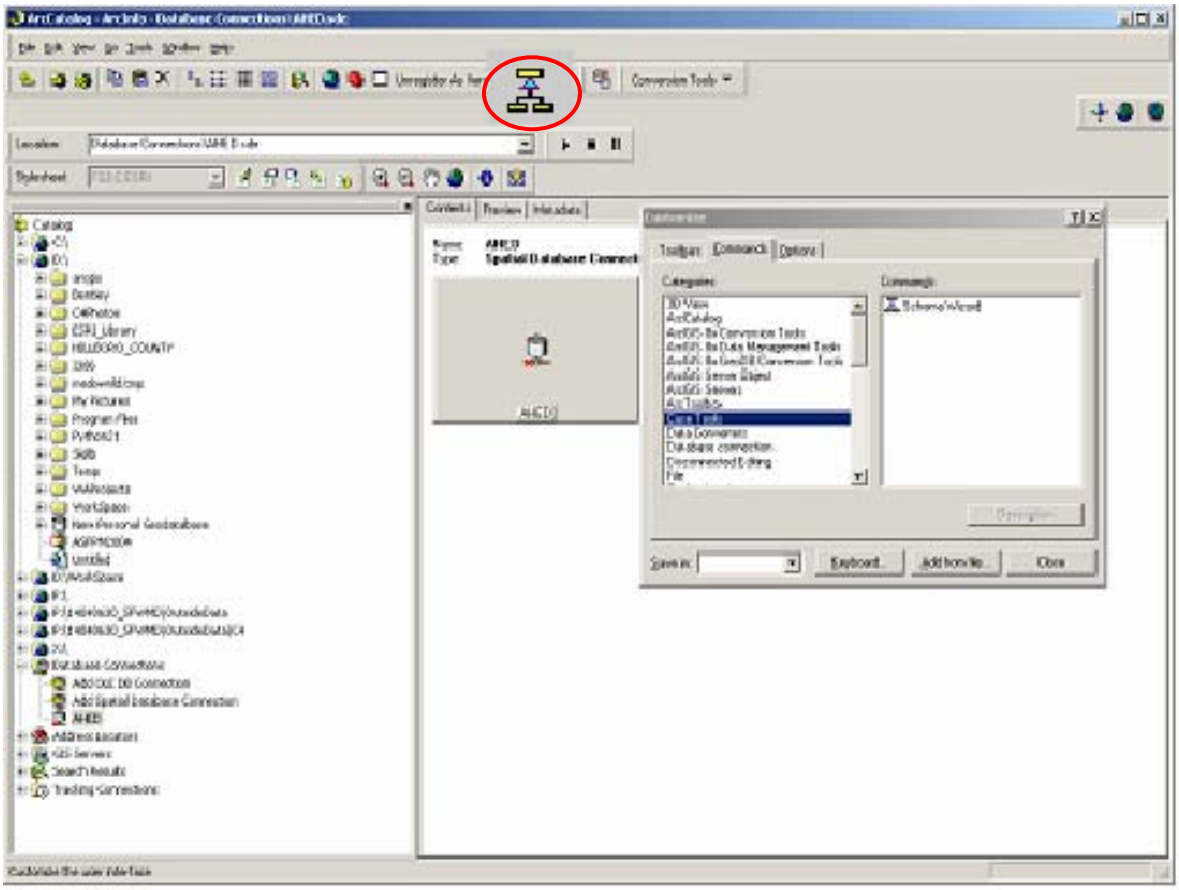


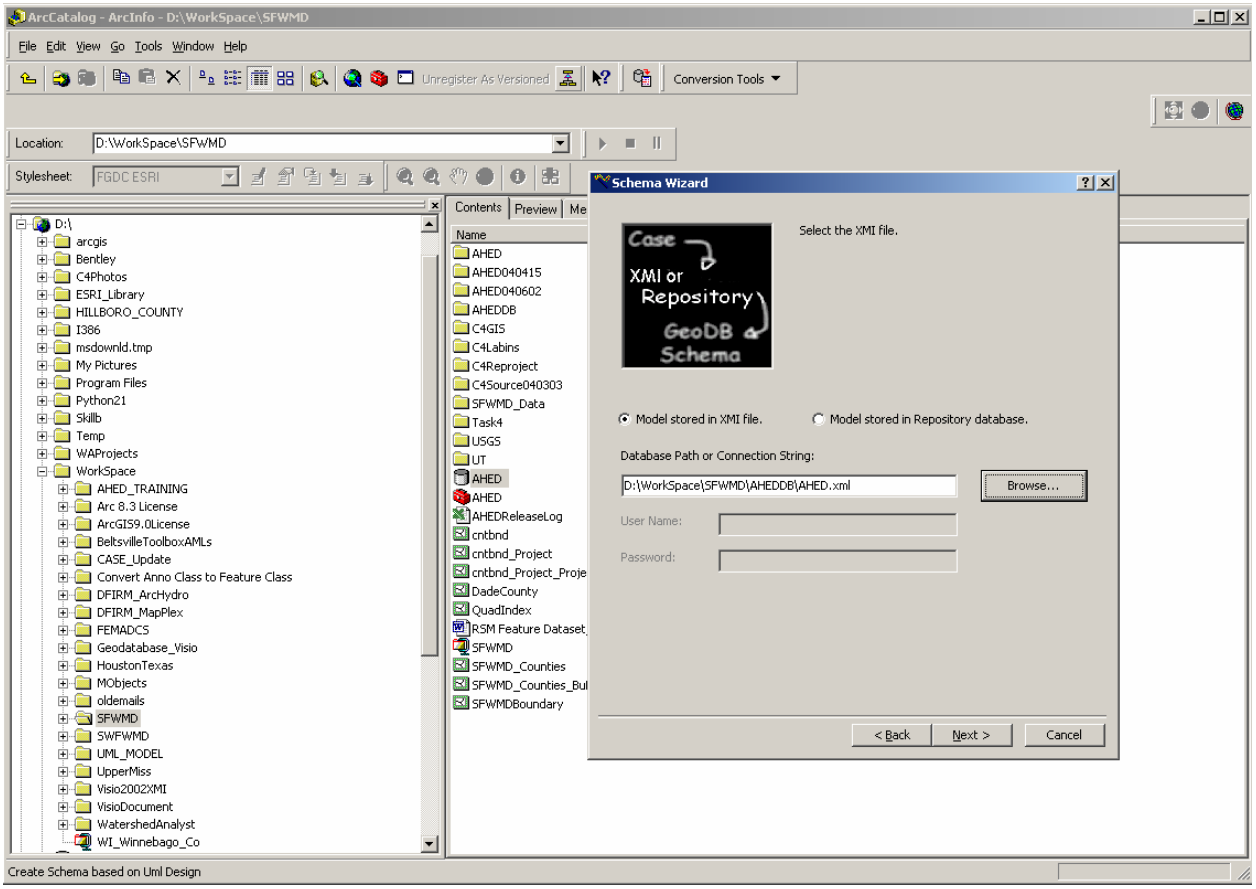
Connect to Server: orabld1
Service: port: 5158
Database: sfahd

User Name: ahed

Drag Schema Wizard into ArcMap:

The user will open Arc Catalog and add the Schema Wizards tool by right clicking in the gray area and selecting customize, clicking the Commands tab, selecting Case Tools and dragging the “Schema Wizard” icon onto Arc **Connection Parameters**

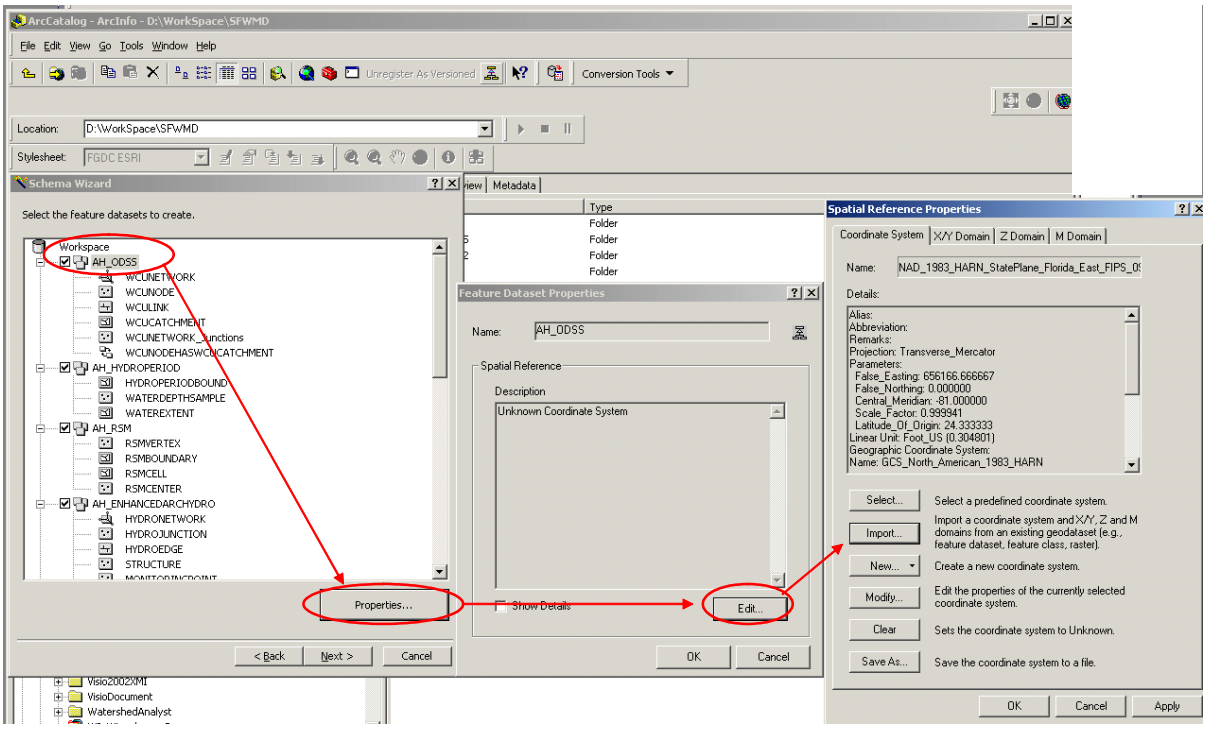




Click on the “Schema Wizard” Icon in Arc Catalog and browse to the AHED.xml file. Click “Next”

*The Map Projection and XYZ Domain for each Feature Dataset and Spatial Index Grid Size values for each Feature Class are set in the Schema Wizard dialogs because one is not able to store these parameters here with Visio in the UML diagram.

Set AHED Spatial Reference Parameters:



In order to set spatial reference:

1. Select Feature Dataset
2. Click “Properties”
3. Click “Edit”
4. Set Spatial Reference parameters based on standard configuration:

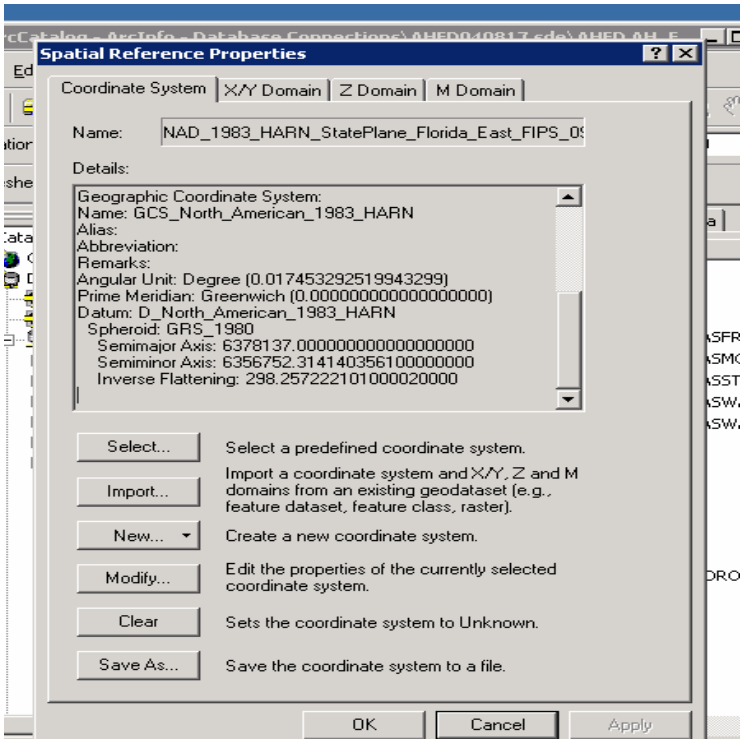
Projected Coordinate System:
Name: NAD_1983_HARN_StatePlane_Florida_East_FIPS_0901_Feet
Projection: Transverse_Mercator
Linear Unit: Foot_US (0.304801)
Geographic Coordinate System:
  Name: GCS_North_American_1983_HARN
  Datum: D_North_American_1983_HARN

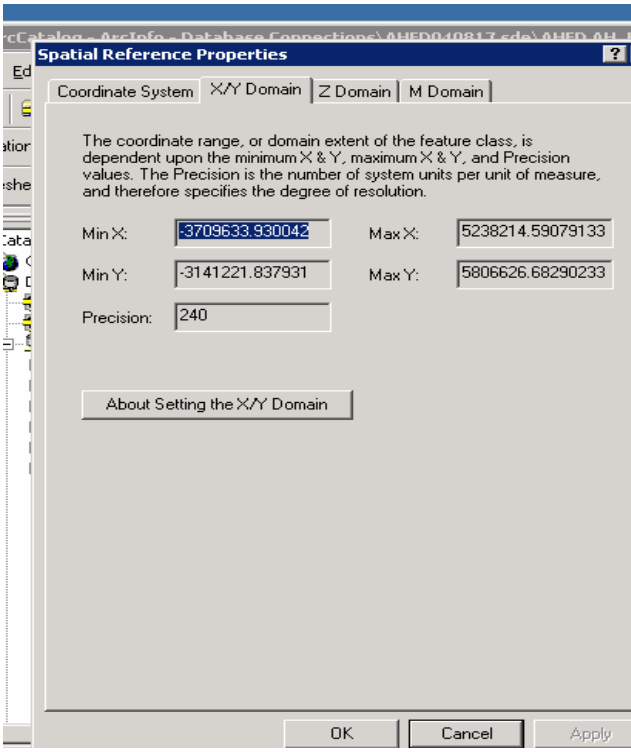
X/Y Domain:
  Min X: -3709633.930042
  Min Y: -3141221.837931
  Max X: 5238214.590791
  Max Y: 5806626.682902
  Scale: 240.000000

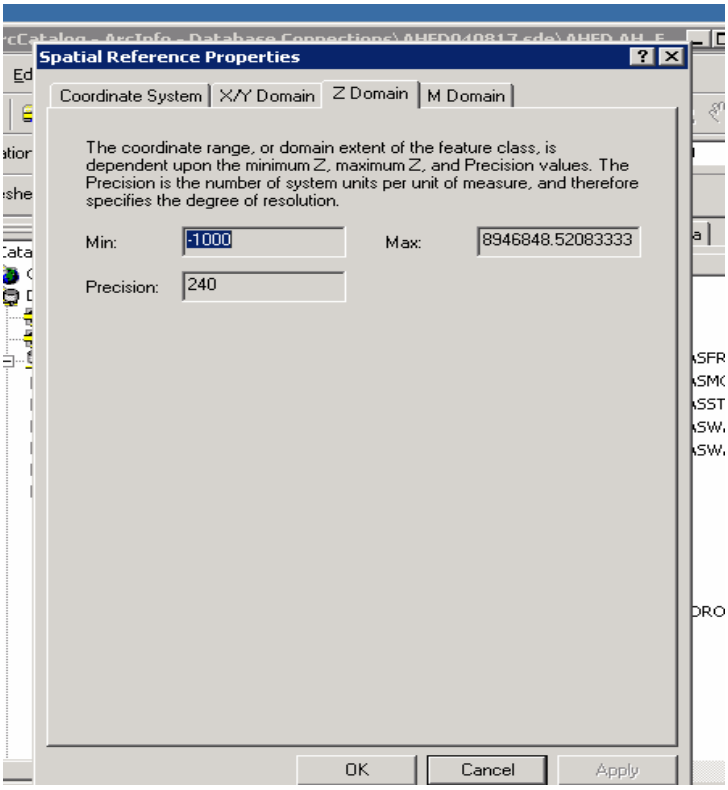
M Domain:
  Min: 0.000000
  Max: 8947848.520833
  Scale: 240.000000

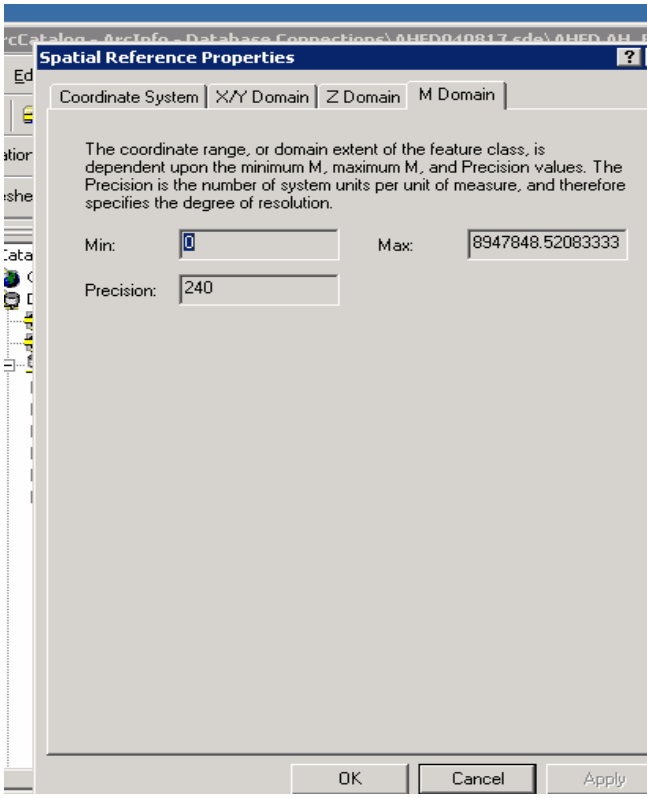
Z Domain:
  Min: -1000.000000
  Max: 8946848.520833
  Scale: 240.000000

Spatial Reference Guidelines:

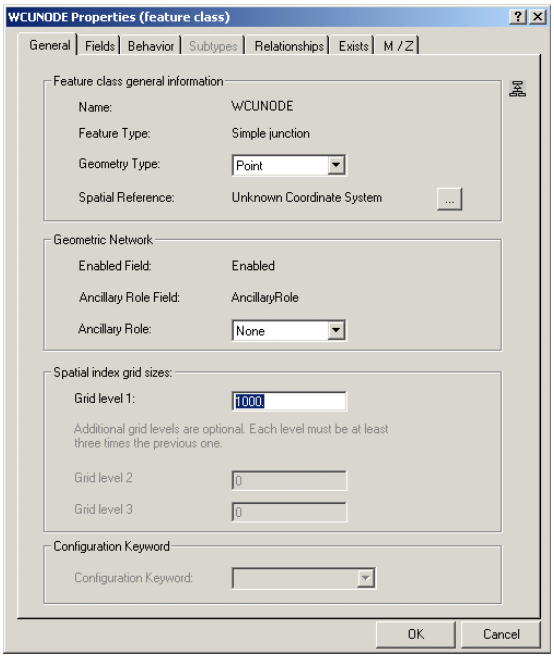








Set Grid size for each dataset to be loaded:



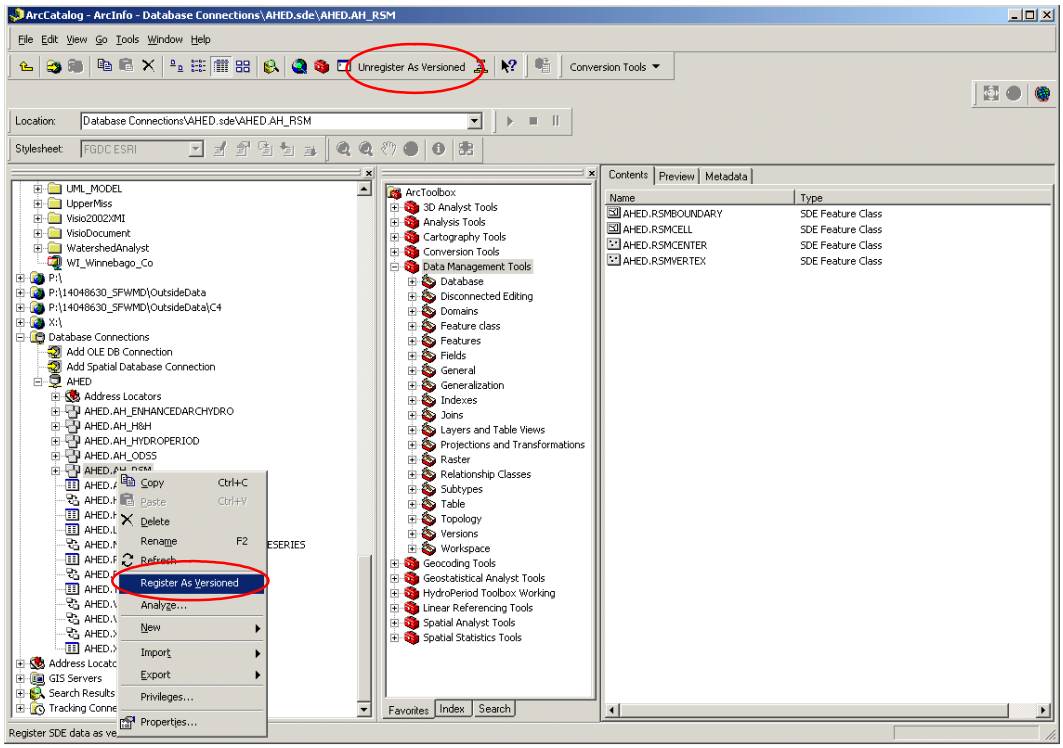
Initial attempts of loading AHED data into ArcSDE failed with an error message reading "Spatial Index Too Small" for some layers . To correct the error use ArcGIS 9 Toolbox command "Calculate Default Spatial Index Grid." This provides some guidance in assigning initial spatial index grid sizes.

Set Spatial Reference Domains for Appropriate Datasets:

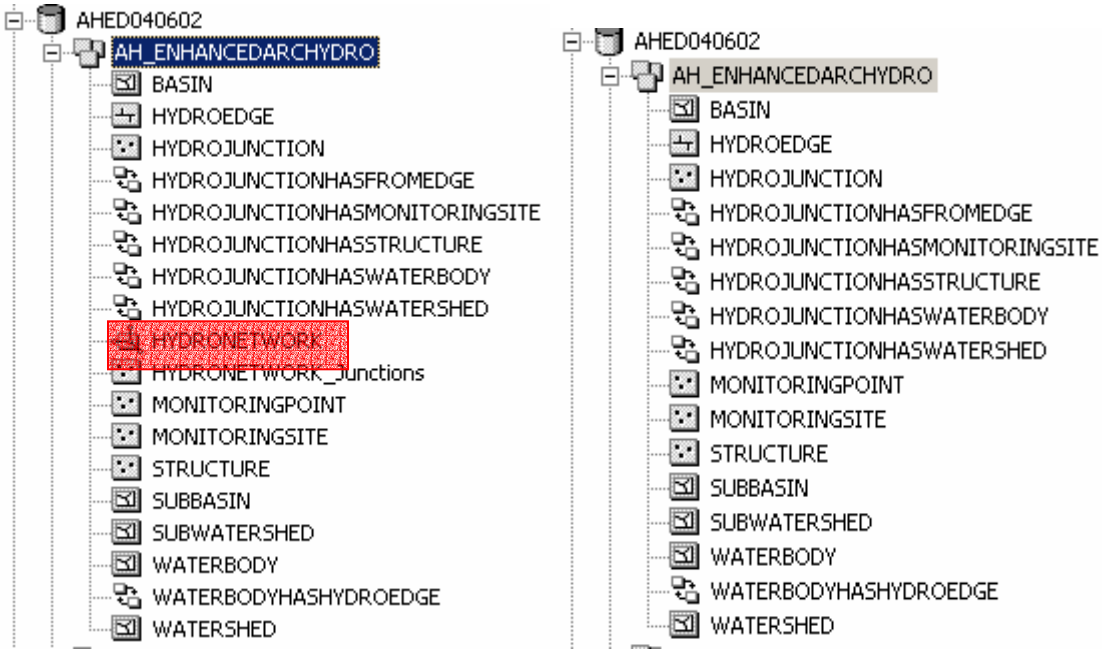
Has M Domain:
HydroEdge
ProfileLine

Has Z Domain:
Waterbody
XSection

3. Use ArcCatalog to Register all Feature Datasets as "Versioned"



4. Load any feature class that is a member of a Feature Dataset into the new Schema using the ArcMap Load Objects command.

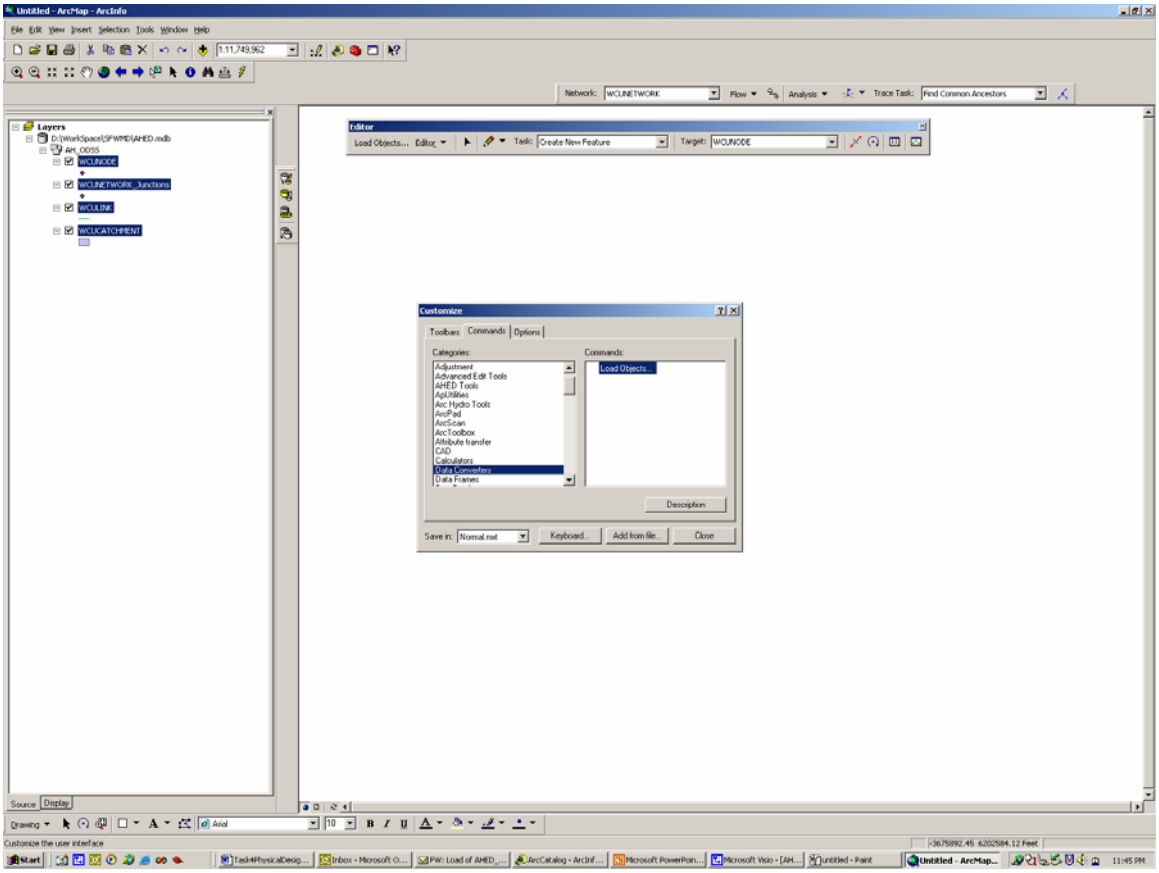


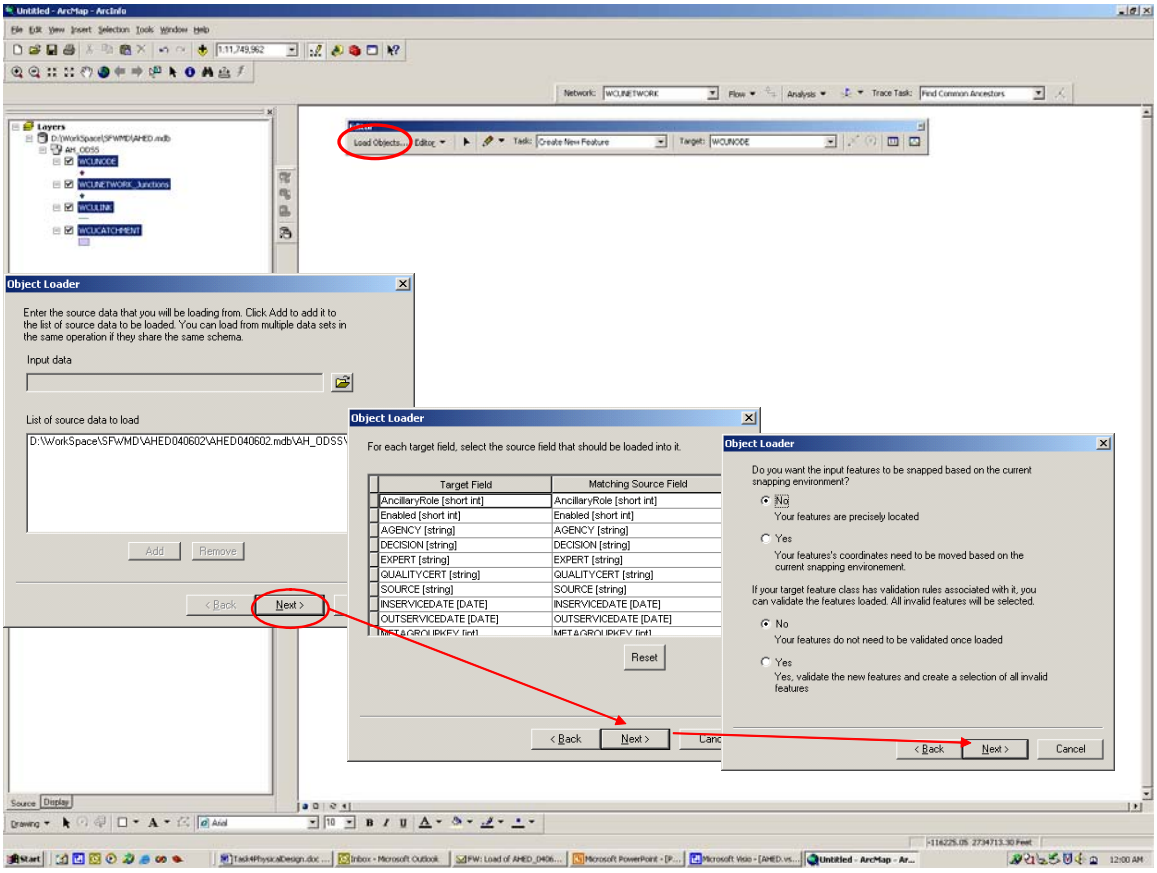
In order to increase the speed of loading features into ArcSDE, the Geometric Networks from AH_ENHANCEDARCHYDRO and AH_ODSS were deleted and are rebuilt in a later step.

Special Consideration for Data Loading prior to executing Load Objects:

1. *Restart SDE after deleting network before loading data to ensure all changes to date are written to the geodatabase.*

Right click in gray area of ArcMap, select customize, click the Commands tab, highlight "Data Converter" and choose "Load Objects".





Using ArcMap, perform the following for each Feature Class.

a) Add the Feature Class to ArcMap
b) Start Editing
c) Using Load Objects command, select Personal Geodatabase feature class and load data into the ArcSDE Layer.
d) Stop Editing and Save Edits.
e) Turn on layer and/or open attribute table to confirm layer was loaded properly.

Special Considerations for Load Objects:

1. *The Load Objects command is used to open an edit session and load data through ArcMap into geodatabases that store relationship classes or network features. This is a slow process when loading large datasets such as full 1:24K National Hydrography Datasets. It is important to leave time for the loading and be aware of potential conflicts such as systems being taken offline for scheduled backup overnight. SFWMD will explore alternative process of dropping relationship classes and using Simple Dataloader in ArcCatalog to improve loading performance.*

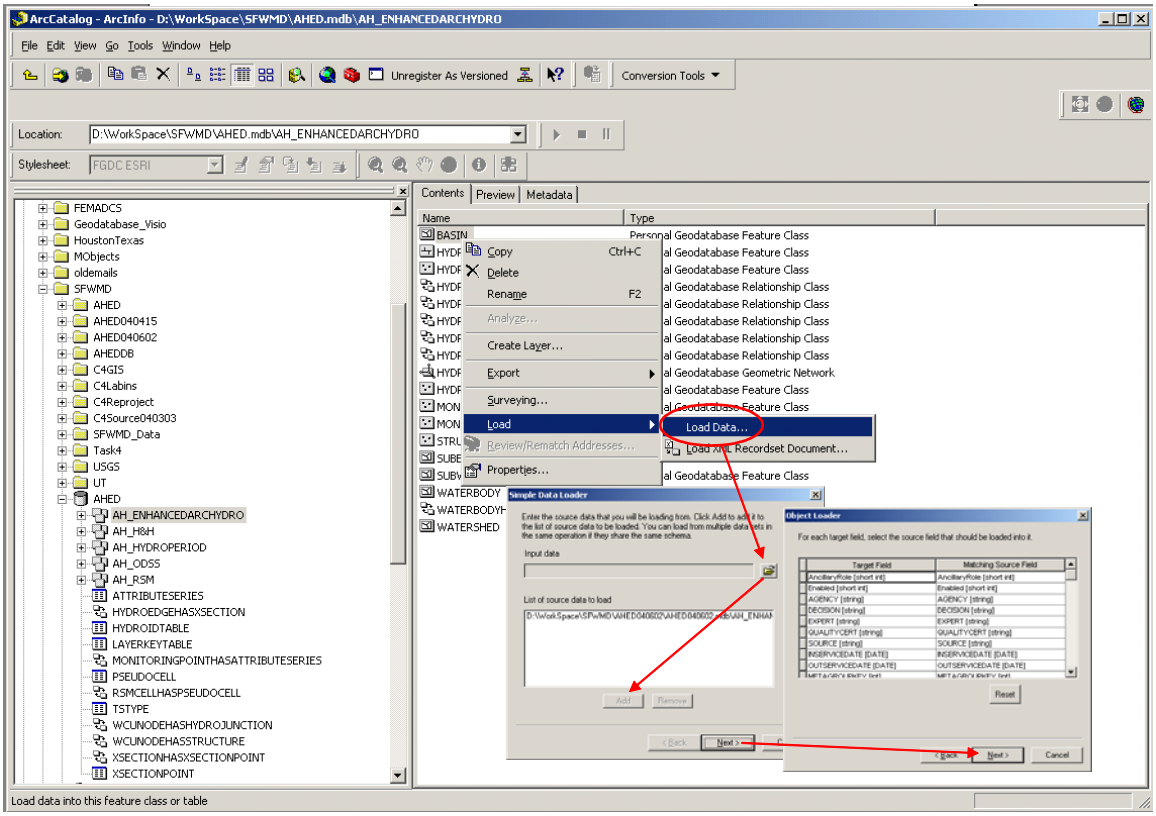
2. *CAUTION: When loading existing Arc Hydro (AHED) dataset under ArcSDE 9.0 (SDE only, does not occur with personal geodatabases) –HYDROID's are recreated. Issue encountered during initial load. This will cause all existing foreign keys in the source dataset, if they are populated, to contain the wrong*

HYDROID reference. The issue was addressed during implementation of the physical design by rebuilding the relationships. This issue will be investigated with ESRI during October/November 2004 under Task 5 to find a work-around because similar data loads will be required.

--HydroIDs reset because the Arc Hydro tools are configured to automatically assign IDs during data load. There is a way to disable if you are completely reloading SDE from personal geodatabase. This will help with frequent data reloads during testing. I need to follow up with Dean on how to do this. However, for long term implementation we would not want to disable assignment, as it would create potential for errors. Long term strategy for maintaining HydroID should address these issues.

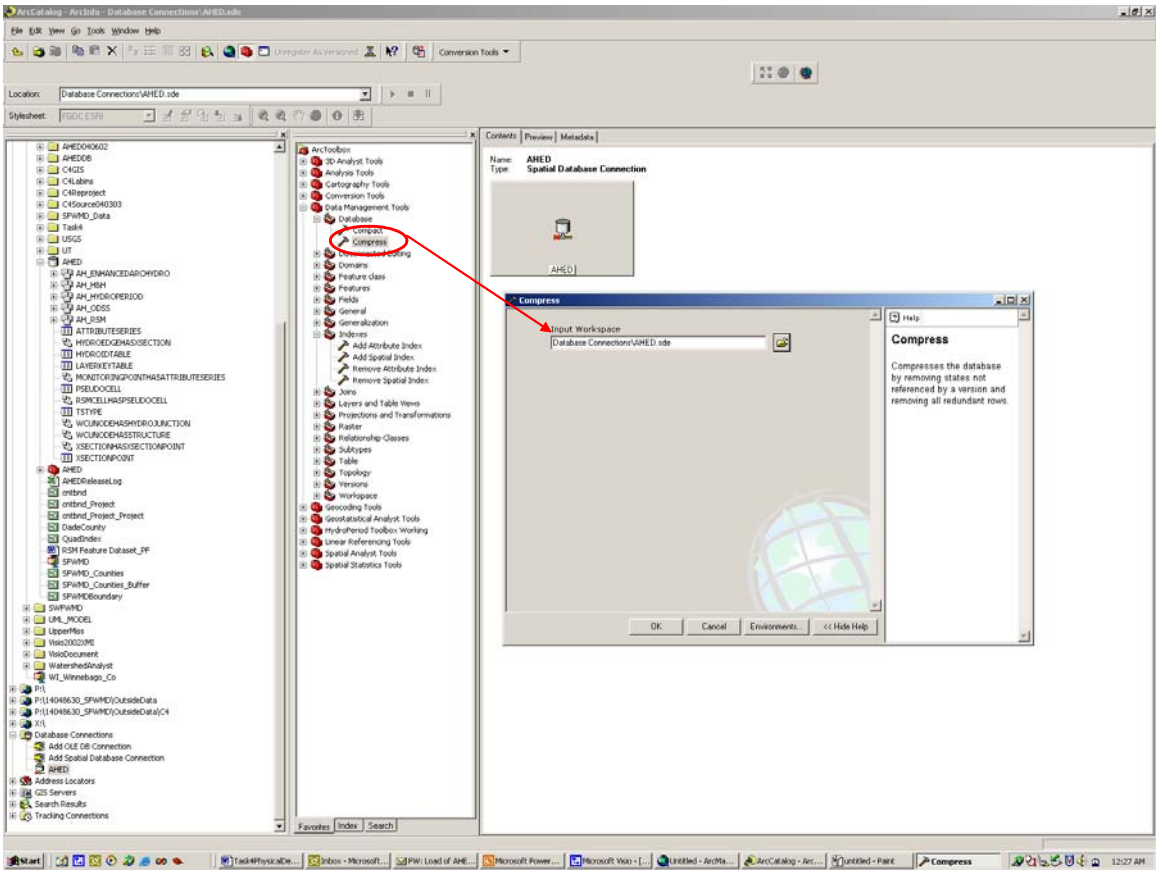
5. Load any Standalone Table data using the ArcCatalog Load Data command

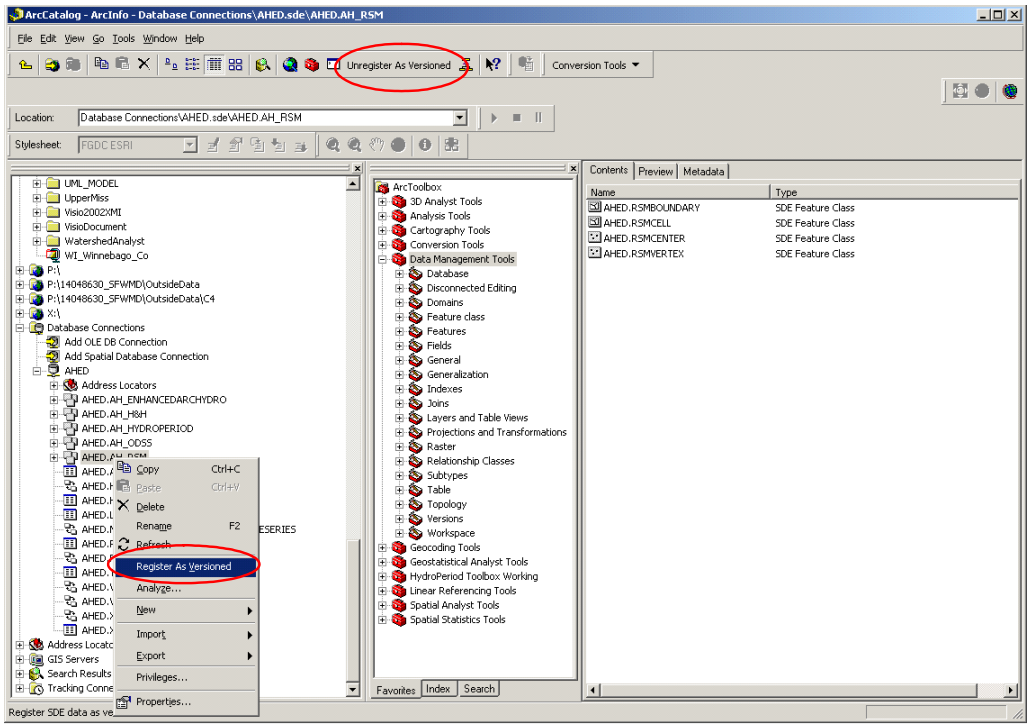
Using ArcCatalog, load any non-spatial tables, and feature classes that are not a part of a network or feature classes that do not participate in a many to many relationship using the Simple Data Loader.



6. Perform a Compress of the Geodatabase

After all data loading is completed, connect as the SDE Oracle user account, then compress ArcSDE Geodatabase using ArcCatalog Compress command in the Data Management Toolbox (under database) in Arc Toolbox or command line command "sdeversion -o compress".



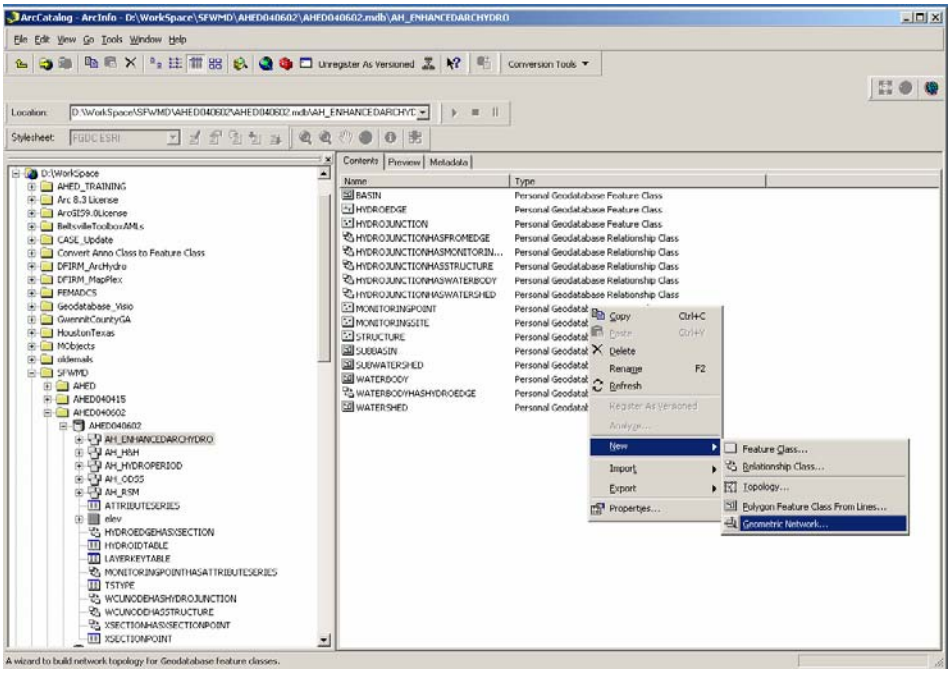


In ArcCatalog, add "Unregister As Versioned" command to the "Enterprise Feature Dataset" Context Menu.

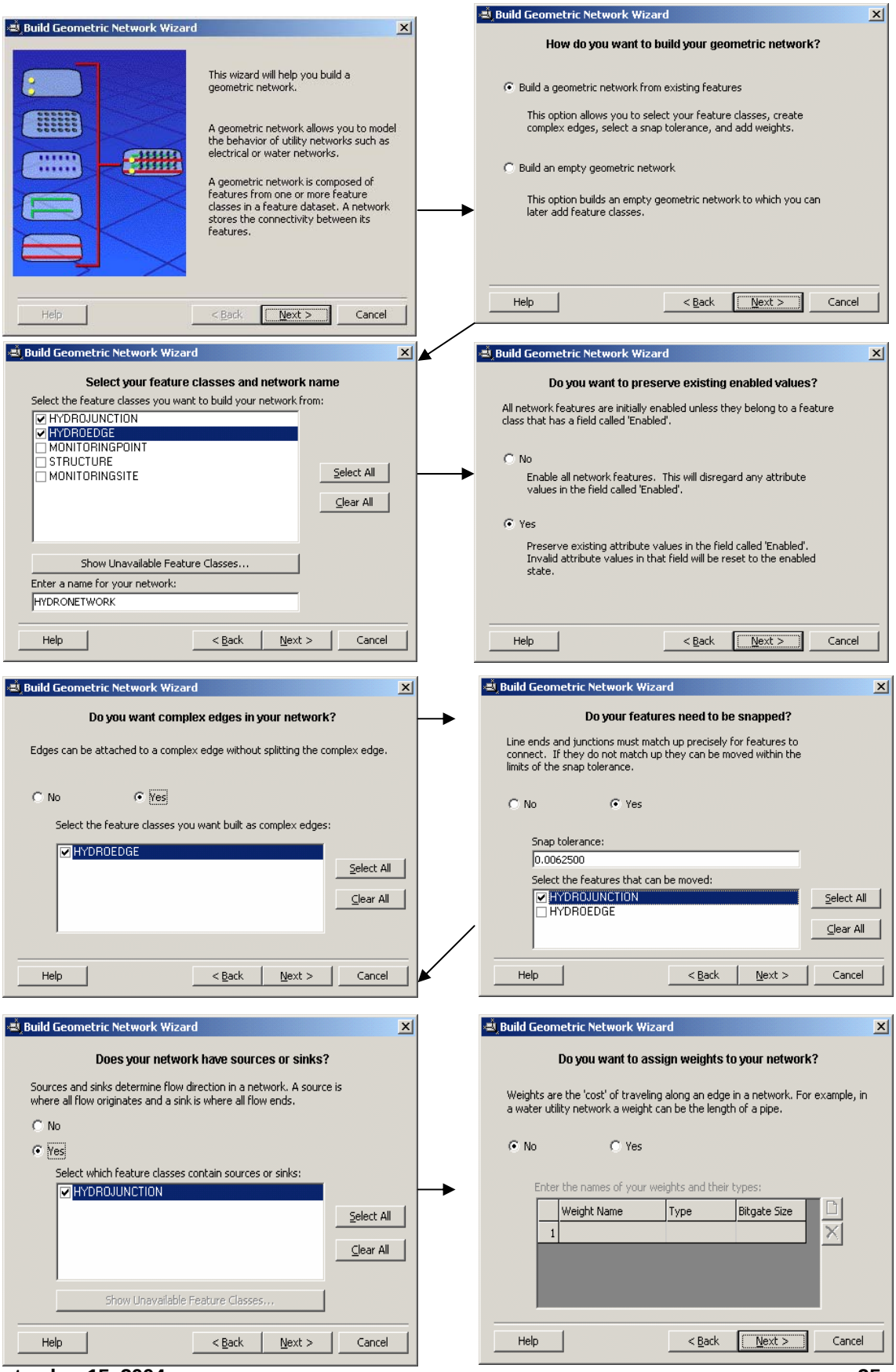
While connected using the AHED user account, Unregister as Versioned "AH_ENCHANEDARCHYDRO" and "AH_ODSS" Feature Datasets.

7. Re-create the Geometric Networks

For "AH_ENCHANEDARCHYDRO" and "AH_ODSS" Feature Datasets.



BUILDING A GEOMETRIC NETWORK FOR "AH_ENHANCED ARCHYDRO"



FOR THE ODSS NETWORK a similar method is used:
Select "No" for Complex Edges, "Yes" for WCUNode features to be moved, "No" Sources or Sinks, and finally no Network weights assigned.

8. Run a final compress

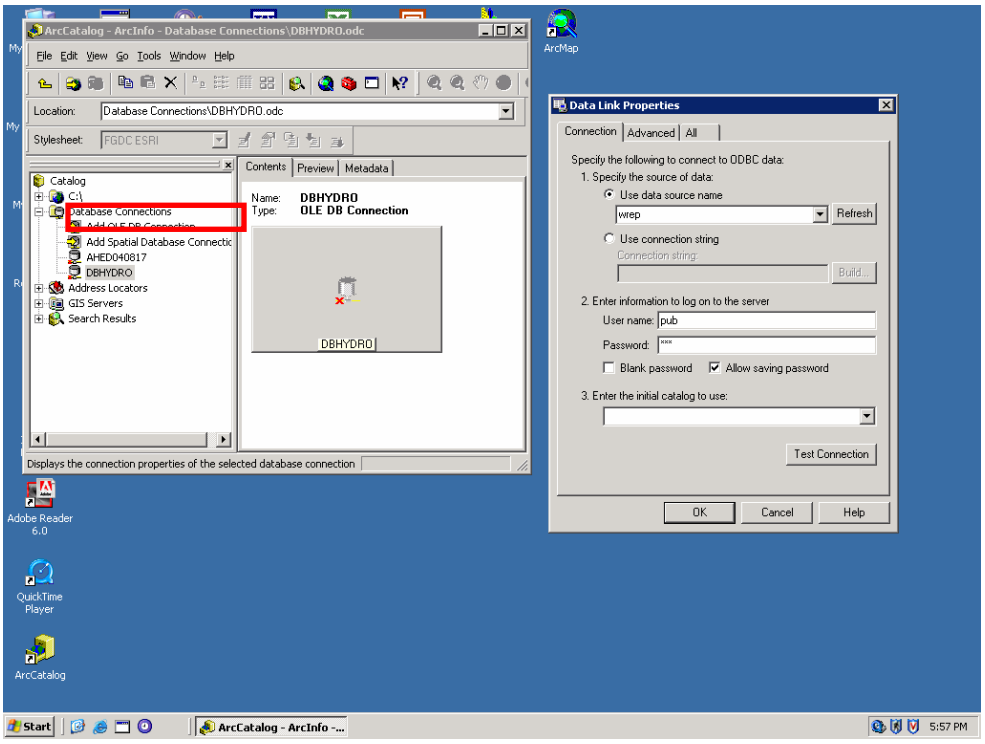
Run a final compress on the Geodatabase to make sure all data has been moved from the ArcSDE layer's "Adds" and "Deletes" tables into the main feature tables. Run this compress before performing any updates to the attribute tables using Oracle SQL commands.

An additional step would be to adjust spatial index grid sizes using command line sdelayer commands. The grid sizes may change dependent on the number of features and size of line or polygon features in these layers.

9. DBHydro Attribute Link

The feature class MonitoringPoint links to DBHydro to access existing station attributes without having to store them in the geodatabase itself. The method for connecting to DBHydro and linking to attribute tables is described below:

Connect to DBHydro via ArcCatalog:

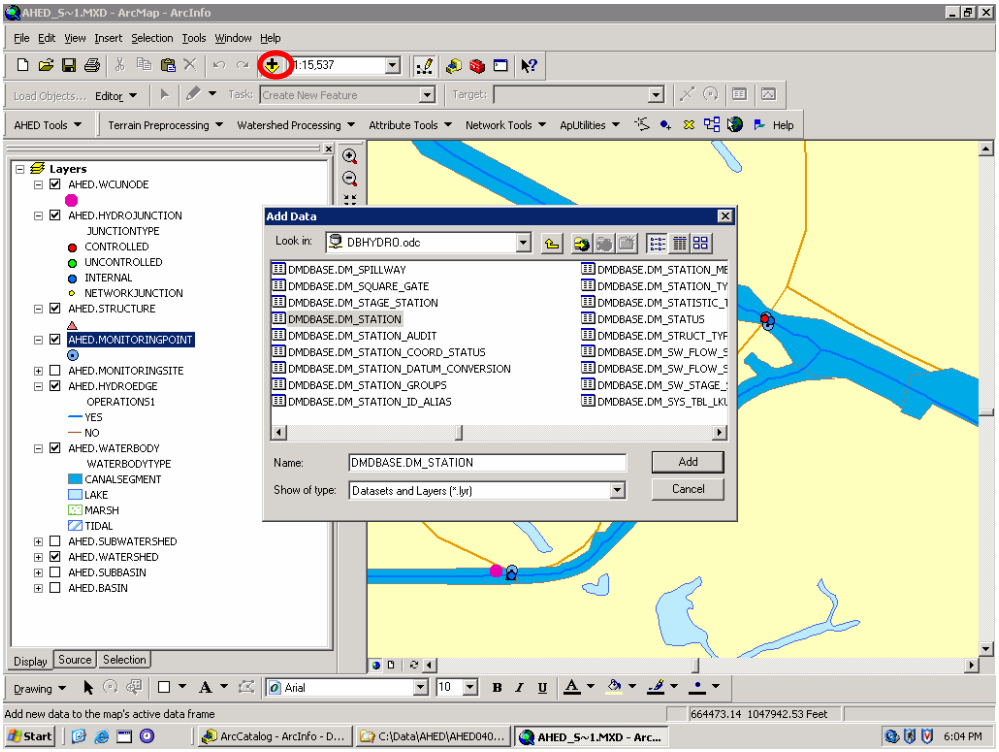


Connection Properties -

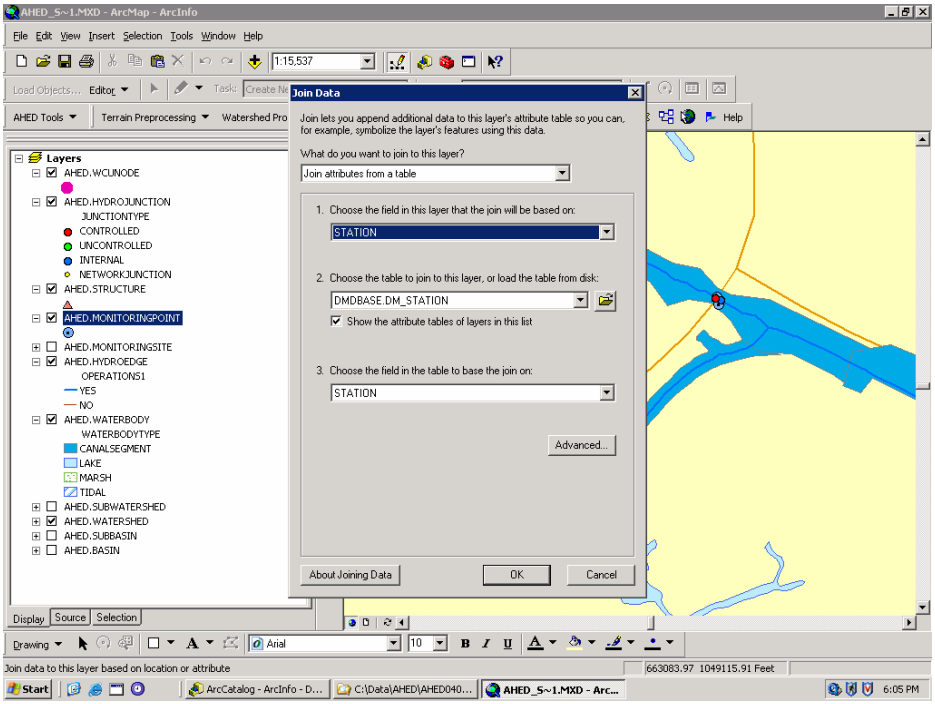
Specify Data Source: wrep
User name: pub
Password: pub

Add DBHydro table to ArcMap mxd:

- DMDBASE.DM_STATION (one-to-one relationship)– lists attributes for individual station locations
- DMDBASE.KEYWORD_TAB (one-to-many relationship)– lists attributes for stations by DBKEY



Create one-to-one join between MonitoringPoint and DM_STATION table using STATION field:



Appendix A. SDE DBTUNE file for District ArcSDE 9.0 Oracle 8i testbed

```
/*********************************************************************
*  SDE DBTUNE Configuration Keyword:  AHED_DATA
*  Using storage parameters from config section GISLIB_LARGE.
*  Explicitly specifying Tablespaces: AHEDDATA, AHEDINDEX
*
*  Append this section to existing SFWMD DBTUNE file.
*
*  Create Date: PBS&J, 6-18-2004
*********************************************************************/

##AHED_DATA
GEOMETRY_STORAGE    "SDEBINARY"
ATTRIBUTE_BINARY    "LONGRAW"
UI_TEXT             "AHED_DATA: For loading data for AHED project."
UI_NETWORK_TEXT     "AHED_DATA: For loading data for AHED project."
COMMENT             "AHED_DATA SDE DBTUNE Configuration Keyword."

F_STORAGE           "PCTFREE 10 PCTUSED 90 INITRANS 4
                                    TABLESPACE AHEDDATA
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4)"

F_INDEX_FID         "PCTFREE 10 INITRANS 4
                                    TABLESPACE AHEDINDEX
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4) NOLOGGING"

F_INDEX_AREA        "PCTFREE 10 INITRANS 4
                                    TABLESPACE AHEDINDEX
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4) NOLOGGING"

F_INDEX_LEN         "PCTFREE 10 INITRANS 4
                                    TABLESPACE AHEDINDEX
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4) NOLOGGING"

S_STORAGE           "PCTFREE 10 PCTUSED 90 INITRANS 4
                                    TABLESPACE AHEDDATA
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4)"

S_INDEX_ALL         "PCTFREE 10 INITRANS 4
                                    TABLESPACE AHEDINDEX
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4) NOLOGGING"

S_INDEX_SP_FID      "PCTFREE 10 INITRANS 4
                                    TABLESPACE AHEDINDEX
                STORAGE (INITIAL 10M NEXT 10M
                MINEXTENTS 1 MAXEXTENTS 800
                PCTINCREASE 0 FREELISTS 4) NOLOGGING"

B_STORAGE           "PCTFREE 10 PCTUSED 90 INITRANS 4
                                    TABLESPACE AHEDDATA
                STORAGE (INITIAL 10M NEXT 10M
```

```
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

B_INDEX_ROWID     "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

B_INDEX_SHAPE     "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

B_INDEX_USER      "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

A_STORAGE         "PCTFREE 10 PCTUSED 90 INITRANS 4
                              TABLESPACE AHEDDATA
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

A_INDEX_ROWID     "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

A_INDEX_SHAPE     "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

A_INDEX_STATEID   "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

A_INDEX_USER      "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

D_STORAGE         "PCTFREE 10 PCTUSED 90 INITRANS 4
                              TABLESPACE AHEDDATA
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

D_INDEX_STATE_ROWID "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

D_INDEX_DELETED_AT  "PCTFREE 10 INITRANS 4
                              TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

RAS_STORAGE       "PCTFREE 10 INITRANS 4
```

```
                                TABLESPACE AHEDDATA
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

RAS_INDEX_ID      "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDINDEX
            STORAGE (INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

BND_STORAGE       "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDDATA
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

BND_INDEX_COMPOSITE "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDINDEX
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

BND_INDEX_ID      "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDINDEX
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

AUX_STORAGE       "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDDATA
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

AUX_INDEX_COMPOSITE "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDINDEX
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

BLK_STORAGE       "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDDATA
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4)"

BLK_INDEX_COMPOSITE "PCTFREE 10 INITRANS 4
                                TABLESPACE AHEDINDEX
            STORAGE ( INITIAL 10M NEXT 10M
            MINEXTENTS 1 MAXEXTENTS 800
            PCTINCREASE 0 FREELISTS 4) NOLOGGING"

END
```